

NTSB Hearing

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See--

p. 16: 250 kHz for PTC needed, as expected

p. 23: Union Pacific will install PTC for SCRAA



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Topics to Address

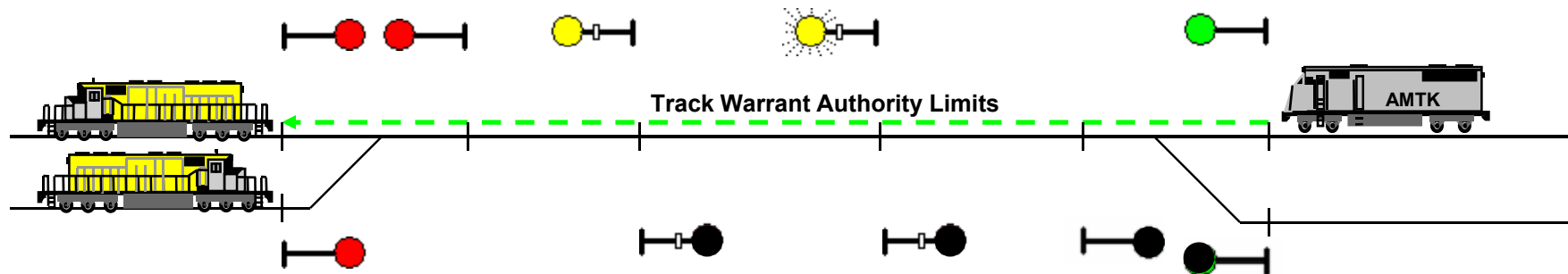
- **Current Train Control Systems**
- **Concerns with Existing Systems**
- **How does PTC Address Concerns with Existing Systems**
- **UP PTC Pilot Locations**
- **PTC Challenges**
- **PTC Implementation Plan**
- **PTC Project Timeline**

Dark Territory Track Warrant Control



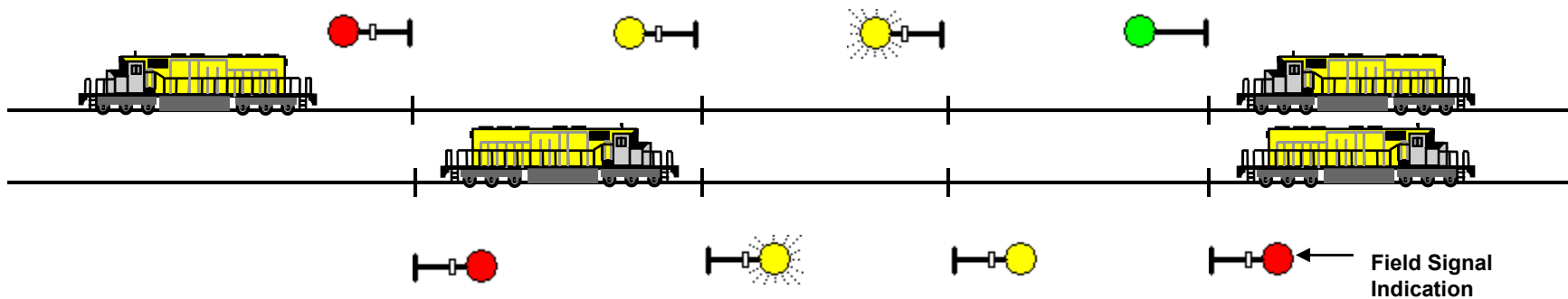
- Main Track Not Signaled
- Movement Authority Conveyed By Track Warrant or Direct Traffic Control permit
 - 2. [X] Proceed From (*Station or Location*) To (*Station or Location*)
On Main Track Spokane Subdivision
 - 8. [X] Hold Main Track At Last Named Point
- Train separation provided by train dispatcher and train crew

Automatic Block System (ABS) Track Warrant Control



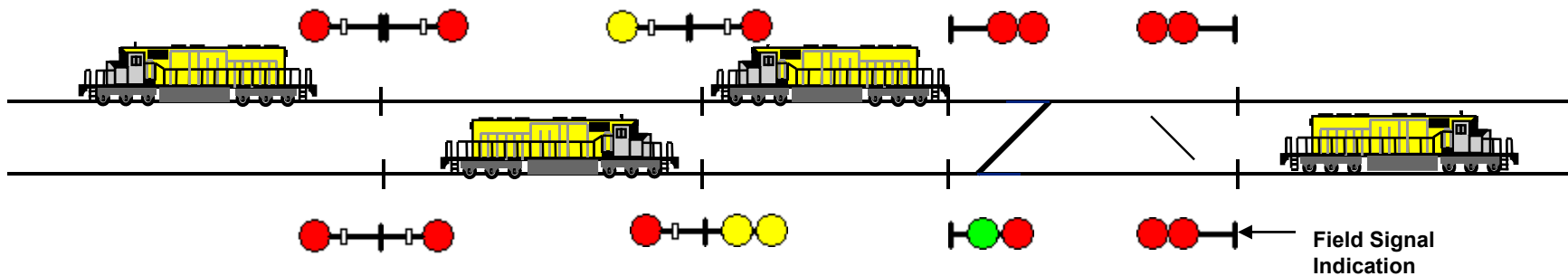
- Main Track Signaled for Movement in Both Directions
- Movement Authority Conveyed By Track Warrant or Direct Traffic Control permit
 - 2. [X] Proceed From (*Station or Location*) To (*Station or Location*)
On Main Track Spokane Subdivision
 - 8. [X] Hold Main Track At Last Named Point
- Train separation provided by train dispatcher, train crew and signal system

Automatic Block Signal (ABS) Current Of Traffic



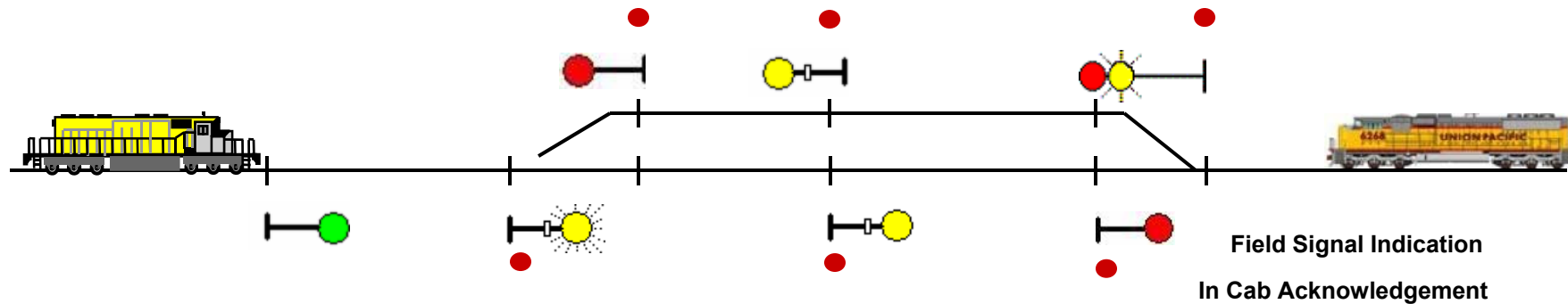
- Two Main tracks with an assigned direction of movement
- Movement authority is conveyed by signal system
- The tracks are only signaled for movement in the assigned direction
- **Train separation provided by train crew and signal system**

Centralized Traffic Control (CTC)



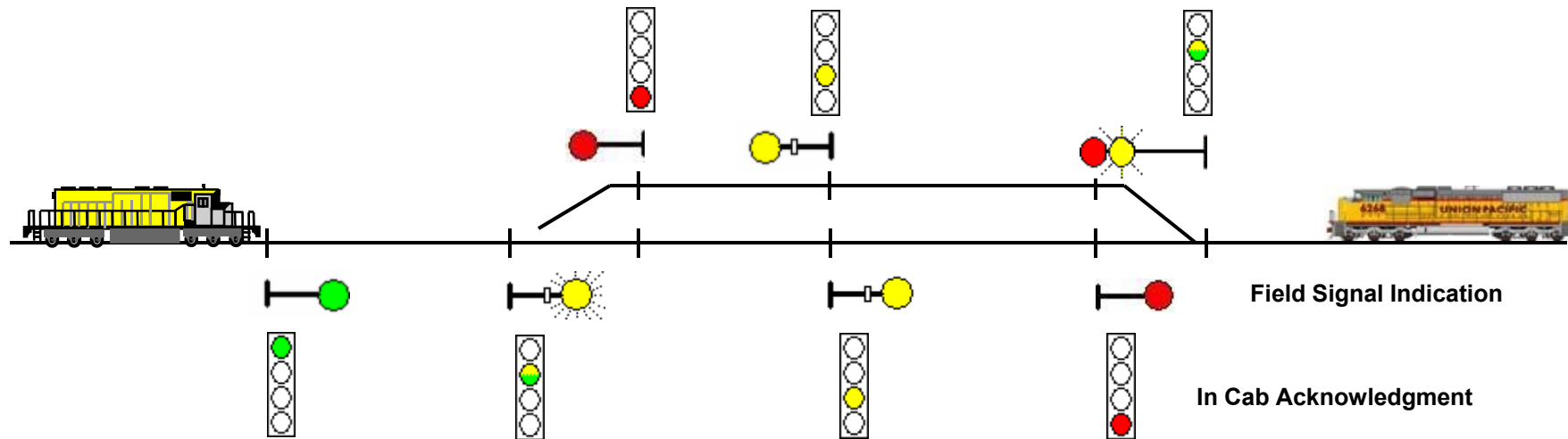
- One or More Main Tracks Signaled for Traffic in Both Directions
- Movement authority is conveyed by signal system
- Train dispatcher controls switches and signals from distant location
- **Train separation provided by train crew and signal system**

Automatic Train Stop (ATS) Operation



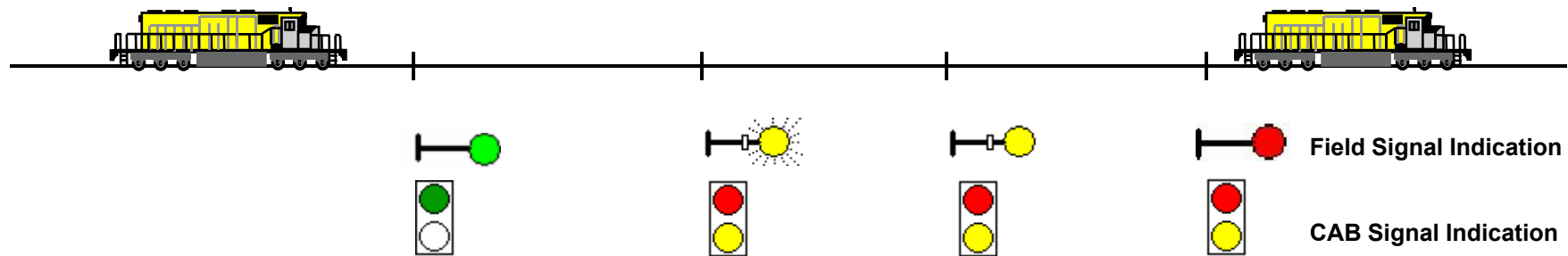
- In Cab alarm sounds when train passes any signal that is not green
- Engineer has six (6) seconds to acknowledge ATS alarm or the train brakes are applied
- Once the acknowledgment is performed, there is no further enforcement
- **Train separation provided by train crew and signal system assisted by ATS alarms**

Automatic Cab Signal (ACS) Operation



- All wayside signal indications are displayed in the locomotive cab
- When locomotive passes a more restrictive signal, engineer must acknowledge within six (6) seconds or the brakes are applied
- Once the acknowledgment is performed, there is no further enforcement
- **Train separation provided by train crew and signal system assisted by ACS alarms**

Automatic Train Control (ATC) Operation



- All wayside signal indications are displayed in the locomotive cab
- When locomotive passes a flashing yellow signal, an alarm sounds and the engineer has six (6) seconds to acknowledge or the brakes will be applied.
- The engineer then has seventy (70) seconds to reduce to 20mph or less, or the brakes will be applied.
- Once the train is under 20mph no further enforcement is applied
- **Train separation provided by train crew and signal system assisted by speed control**

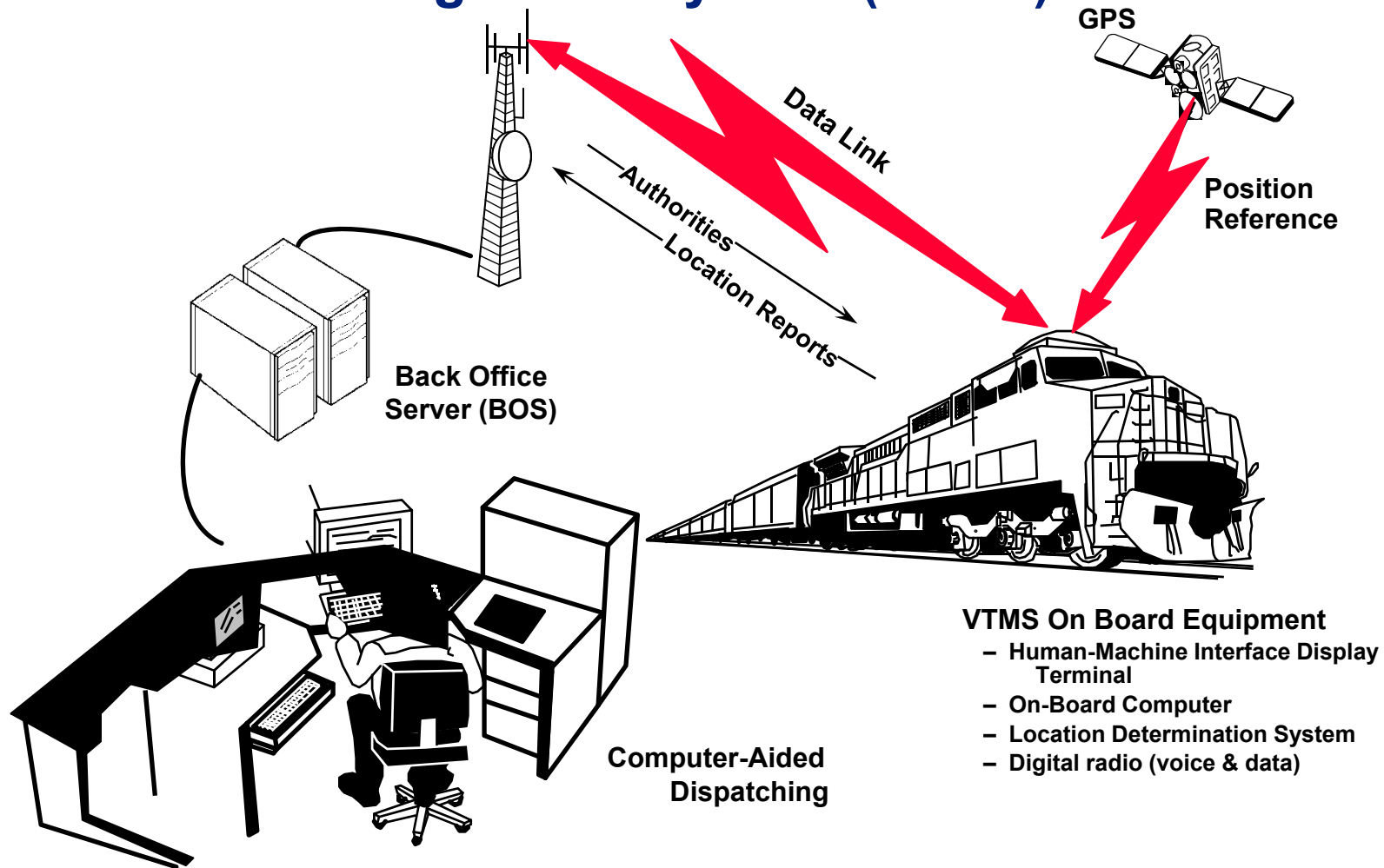
Concerns with Existing Systems

- **Systems are reactive as opposed to predictive**
 - Many systems wait for a violation to occur before any form of enforcement is invoked (ATS and CCS)
- **Systems depend on human compliance**
- **Very time consuming to design and install**

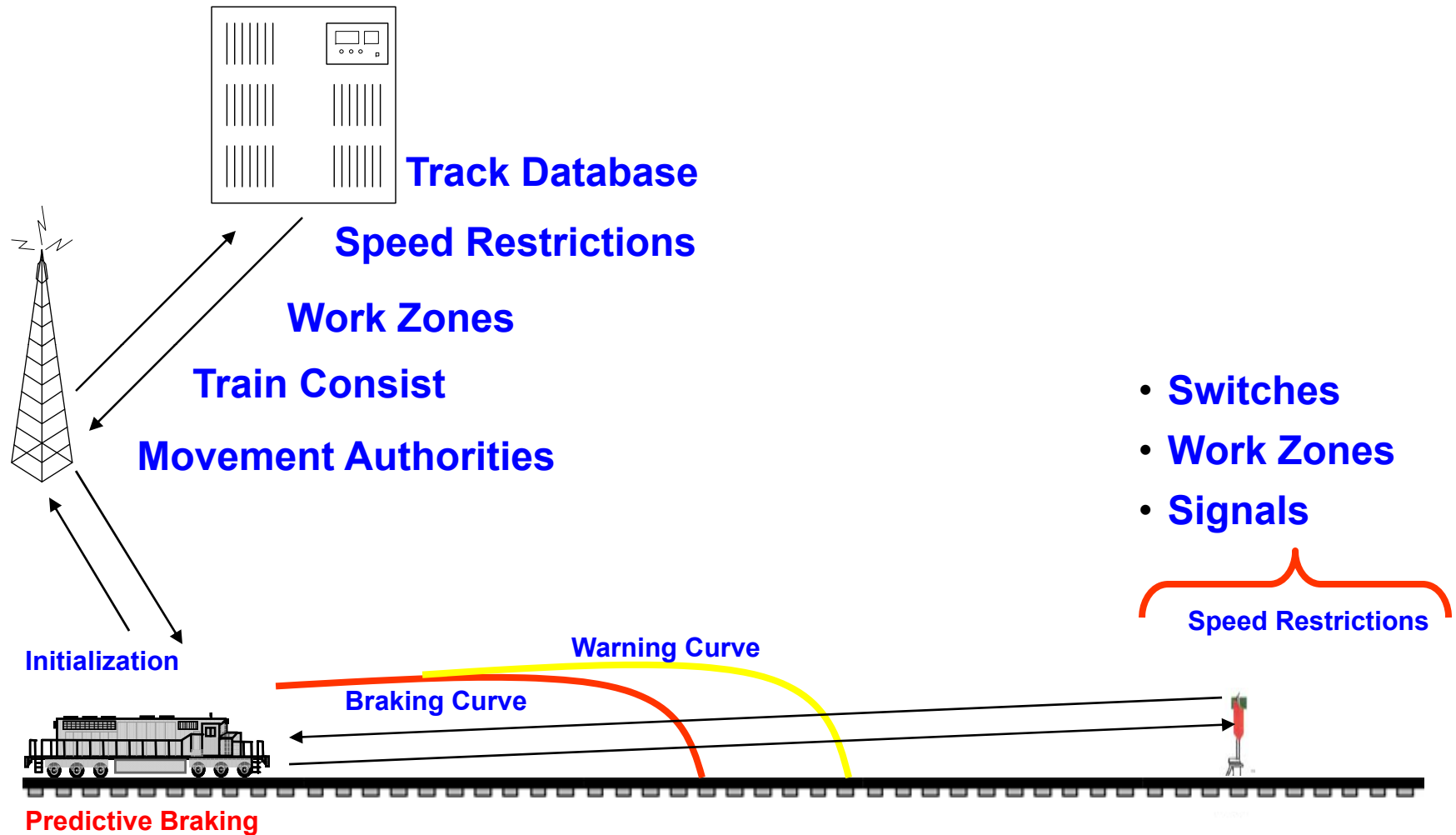
PTC Interoperability Objectives

- **Meet Rail Safety Act requirements**
 - Train to train collisions
 - Incursions of trains into established work zone limits
 - Over-speed derailments
 - Movement of a train through a switch in the wrong position
- **Meet regulatory requirements for production deployment**
 - FRA's new CFR Part 236 Subpart I
- **Support industry interoperability initiatives**
 - Telecomm, system behavior, human factors

UP's PTC System Vital Train Management System (VTMS)

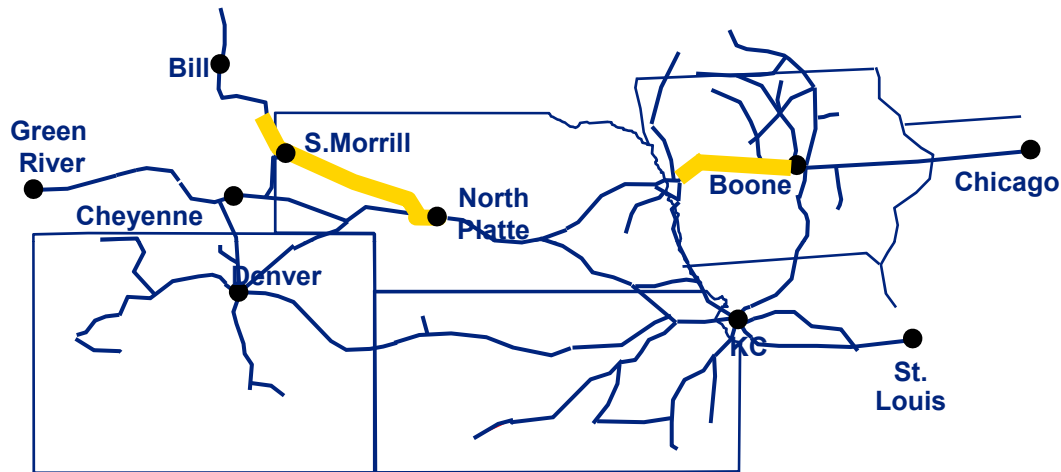


VTMS – System Overview



Vital Train Management System (VTMS)

Pilot Locations



South Morrill & Powder River Subs

- 193 miles multiple track CTC/ACS
- 75+ trains per day
- 50 AC44 locomotives to equip

Boone Sub

- 123 Miles CTC/ATC
- 62 trains per day
- 50 AC44 locomotives

Spokane Sub

- 140 Miles TWC/Dark
- 7 trains per day
- 15 UP SD9043 locomotives and 15 CP locomotives



Positive Train Control (PTC) Challenges

- **Communications Spectrum**
 - Ensuring enough throughput for safe and efficient movement of trains
- **Interoperability**
 - Communications, System Behavior and Response and On Board Display
- **Predictive Enforcement Complexity**
 - Ensure safe braking calculations
- **Installation of Wayside Interface Units (WIUs), Locomotive Equipment and Telecommunications Infrastructure**
 - 24,751 WIUs to install (9.9 per day between now and 12/31/2015)
 - 6,000 Locomotives (2.4 per day between now and 12/31/2015)
 - 970 Base Station Radios
- **Uncertainty with new Subpart I Regulations**

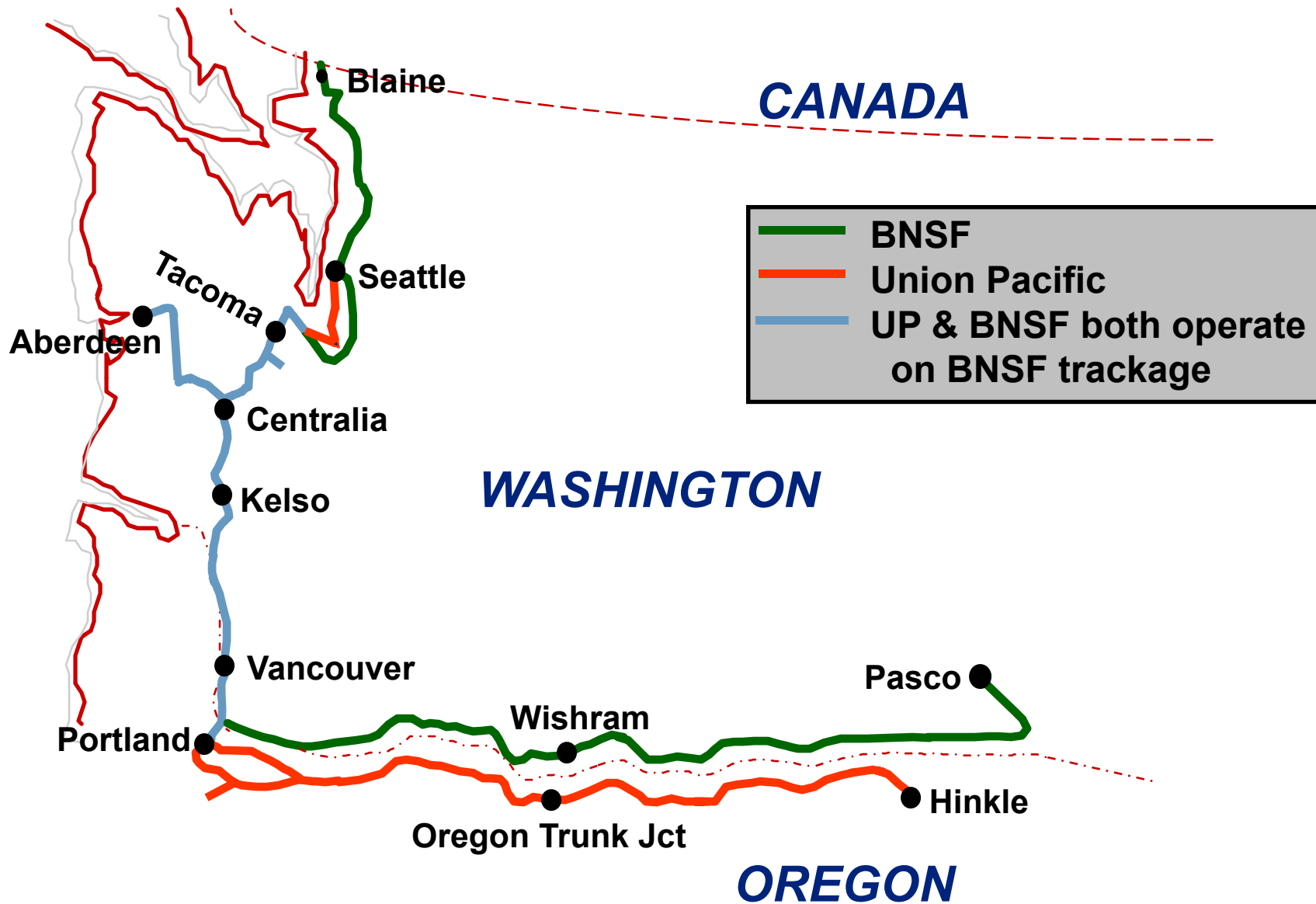
Communications Spectrum

- **Spectrum is like a highway -**
 - **Radio channels are like lanes of the highway**
- **Too much traffic on a channel of Spectrum will cause congestion**
- **The 220 spectrum was purchased by UP and NS to support the expected data traffic from the freight railroads.**
 - **Additional spectrum will be needed as more railroads are added**
- **Early projection for spectrum is ~250 KHz (5 25KHz channel pairs) of 220 MHz spectrum**
 - **Spectrum demand study will commence soon**

Interoperability

- **Communications**
 - Standards that permit one railroad's locomotive to safely and efficiently operate over another railroad's infrastructure
 - UP, NS BNSF and CSX have agreed to interoperable communications standards
- **The four Class 1 railroads have agreed to locomotive display standards**
 - Simplifies training and increases safety through common operating standards
- **UP, NS, BNSF and CSX are using WABTEC for the on board PTC system**

Interoperability Scenario



What is the Interoperability Agreement?

- **BNSF, CSX, NS and UP are signatories**
- **Agreement to implement technical standards for:**
 - Locomotive to wayside communication
 - Locomotive to back office communication
 - Locomotive on board system behavior
 - Locomotive on board displays
- **Agreement for governance**
 - Working committee
 - Steering committee
 - Executive committee
- **Agreement to manage 220 MHz spectrum**

Predictive Enforcement Complexity

- Predictive braking algorithms (software) must stop trains before authority violations with very high degree of reliability
- Algorithms must be smart enough to adapt to changing conditions
 - Weather
 - Train tonnage
 - Different types of cars
 - Weight variation in the train

Uncertainty with new Subpart I Regulations

- **PTC scope beyond CFR 236 Subpart H requirements**
 - **Current PTC systems development has been done to meet the standards with CFR 236 Subpart H**
- **How to deal with Class 2 and 3 railroads exempt from RSIA but operate on Class 1 lines that require PTC**

Priority Areas for Implementing PTC

- **UP has committed to have PTC installed in the LA Basin by 12/31/2012**
- **Commuter/Passenger lines will be next**
 - Southern and Northern California
 - Chicago, Salt Lake City, Denver, etc.
- **Followed by TIH routes**
- **Risk assessment will dictate remaining implementation plan**

[Petitioners Note: This regards SCRAA. As we have shown in past-pleading exhibits, SCRAA is the quoted "guinea pig" for the PTC in the US on 217-222 MHz pushed by PTC 220 LLC's major-freight rail members, including Union Pacific ("UP" as it is called, including above) and BNSF, which Ed Kemp and Michele Farquhar (attorney) speak for. But they keep this hidden from FCC in the MCLM-SCRAA dockets and proceeding. See p. 16 above: re need only 250 kHz. Actually, other metro rail such as DART and AMTRAK have stated directly to Petitioners that they need only about 100 kHz for PTC, including in the NE Corridor, the most highly used train corridor according to some reports, such as one from SYSTRA.]

Project Timeline

